

## Energetic Refurbishment of Brick Buildings

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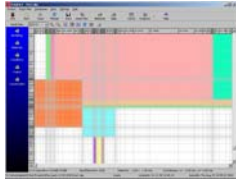
The Institute of Building Climatology

**1. Building physical  
research laboratory**



Multi chamber climate  
test facility

**2. Modeling and  
simulation**



DELPHIN / COND /  
CHAMPS / ...

**3. Application  
and test buildings**



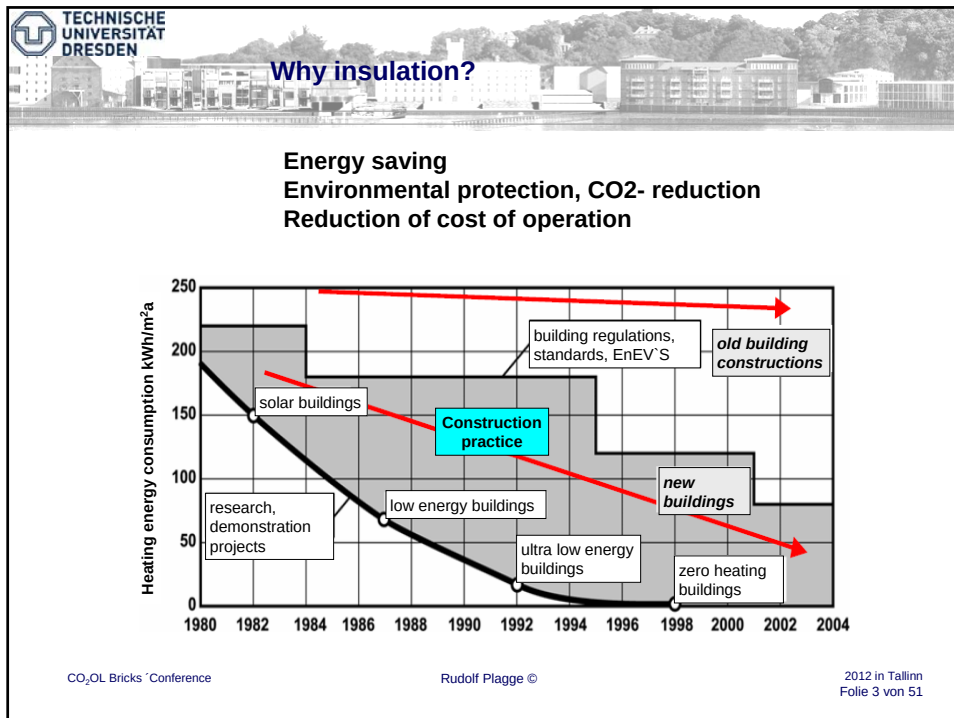
Herrenschiesshaus Nuremberg

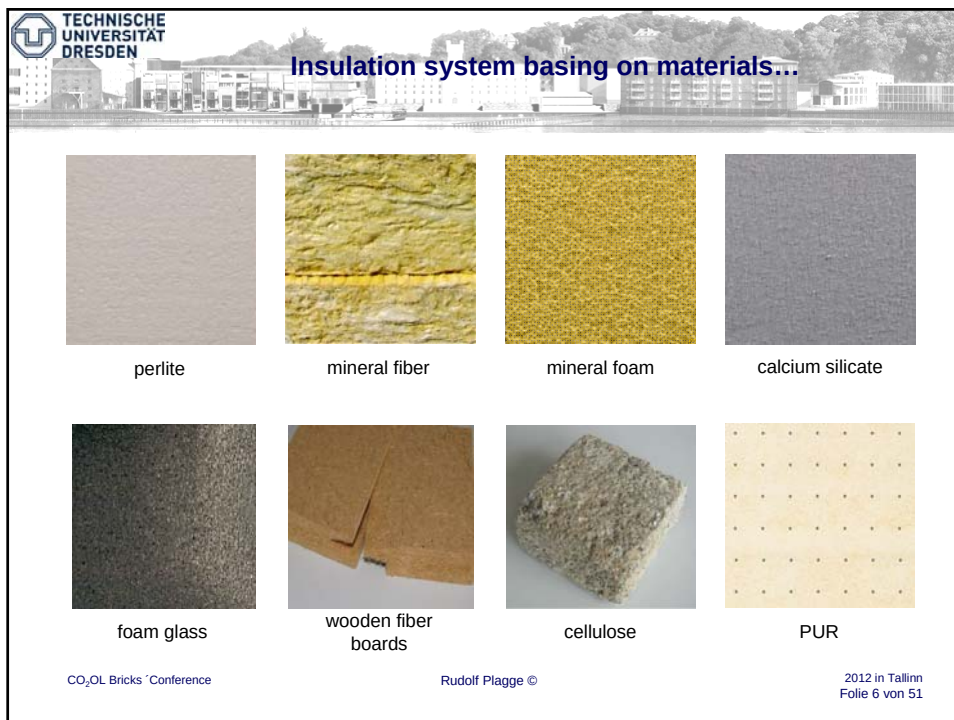
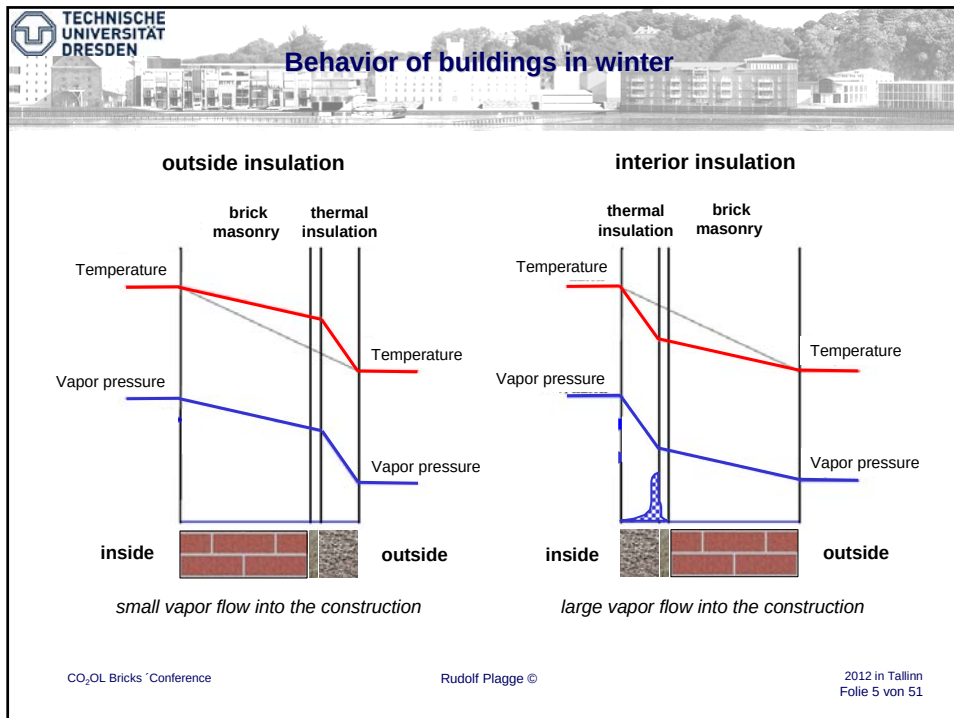
- **Rehabilitation Engineering projects:** Elbe- Philharmony in Hamburg; Historic Storage magazines in Potsdam; Red Barracks in Potsdam; Red Town Hall in Berlin; Rijksmuseum in Amsterdam, NL; Palace Gueterfelde, Tivoli in Berlin Kreuzberg; several town quarters „Am Urban“ in Berlin, „Zöllnerviertel“ in Weimar, ...
- **International cultural heritage projects:** „Humayun Tomb“ in Delhi, India; Museum village of Saporo in Japan; Ayasofia in Istanbul, Turkey; Takamatzusuka Tomb in Japan; ...
- **Modern construction projects:** Saxonian State and University Library, National competition award „Plus energy building & e-Mobility“; ...

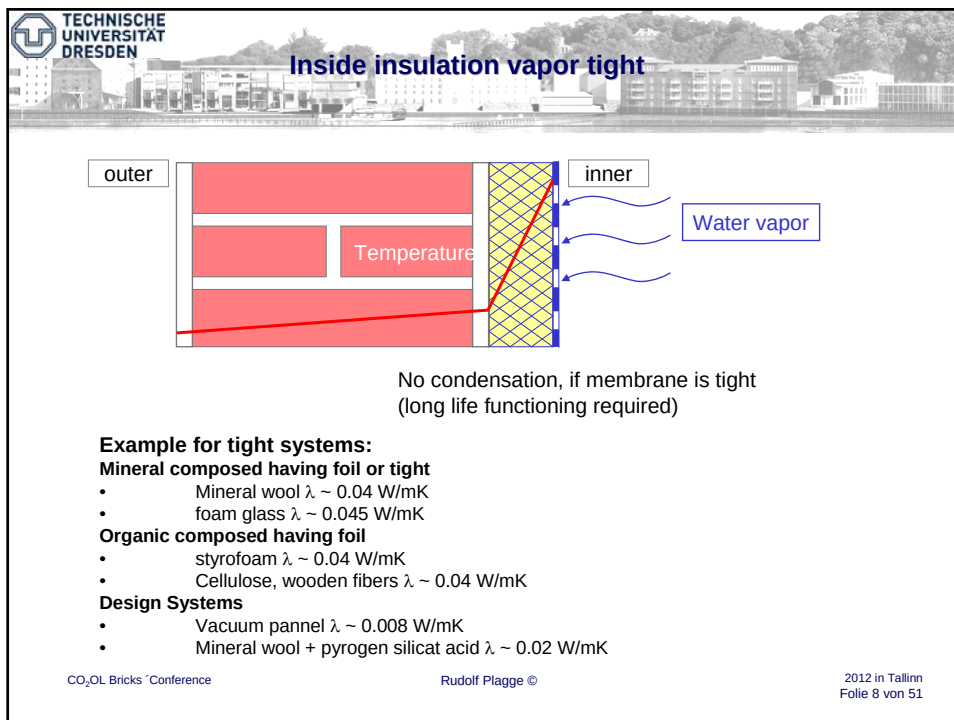
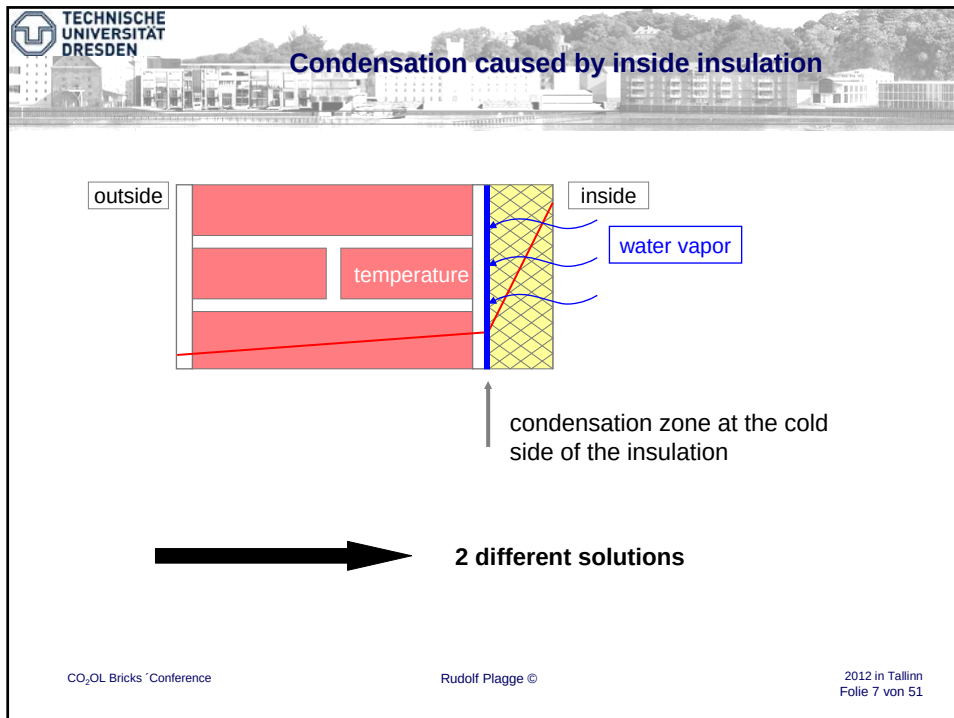
CO<sub>2</sub>OL Bricks Conference

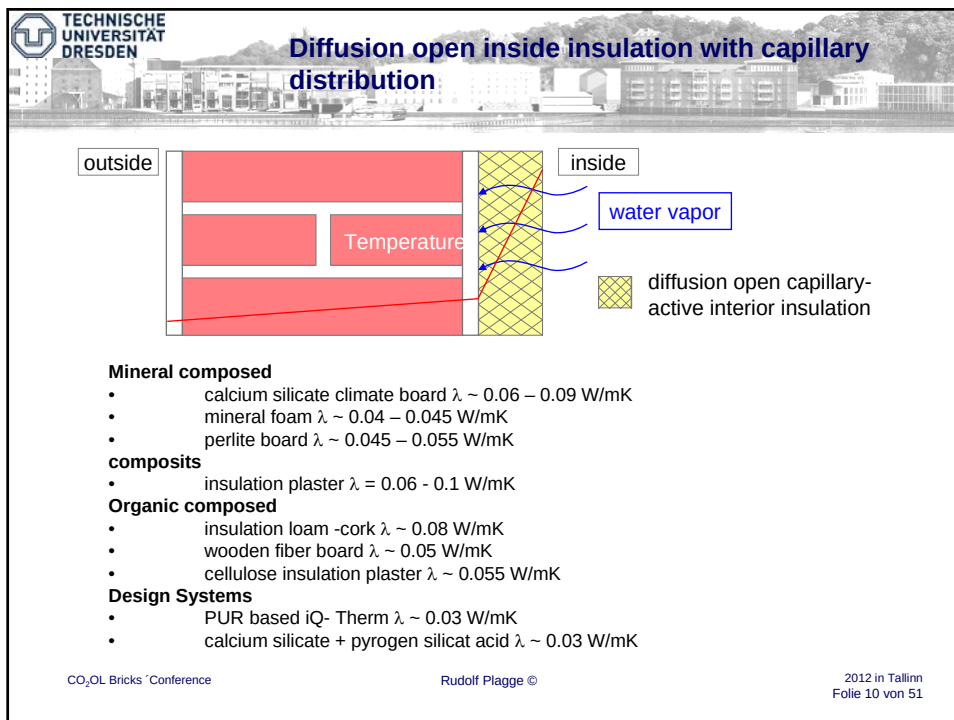
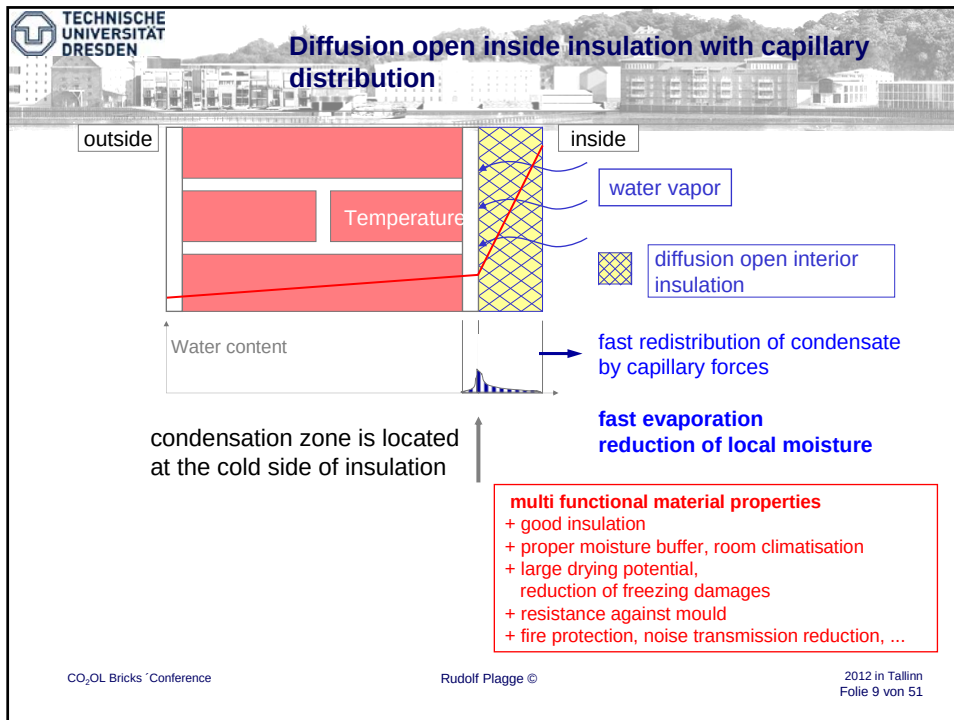
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## Design and development of capillary active interior insulation

During the last 20 years ...

- 1990 → Idea and research approach
- 1995 → Application and test houses
- 2000 → Research projects material optimization
- since 2002 → Application at cultural heritage buildings



Rijksmuseum Amsterdam  
mineral wool, perlite, calcium silicate  
board, iQ-Therm system, on-spray  
cellulose plaster, ...

## Test house management: Wilhelminian style building in Dresden Calcium silicate climate board (Calsitherm)

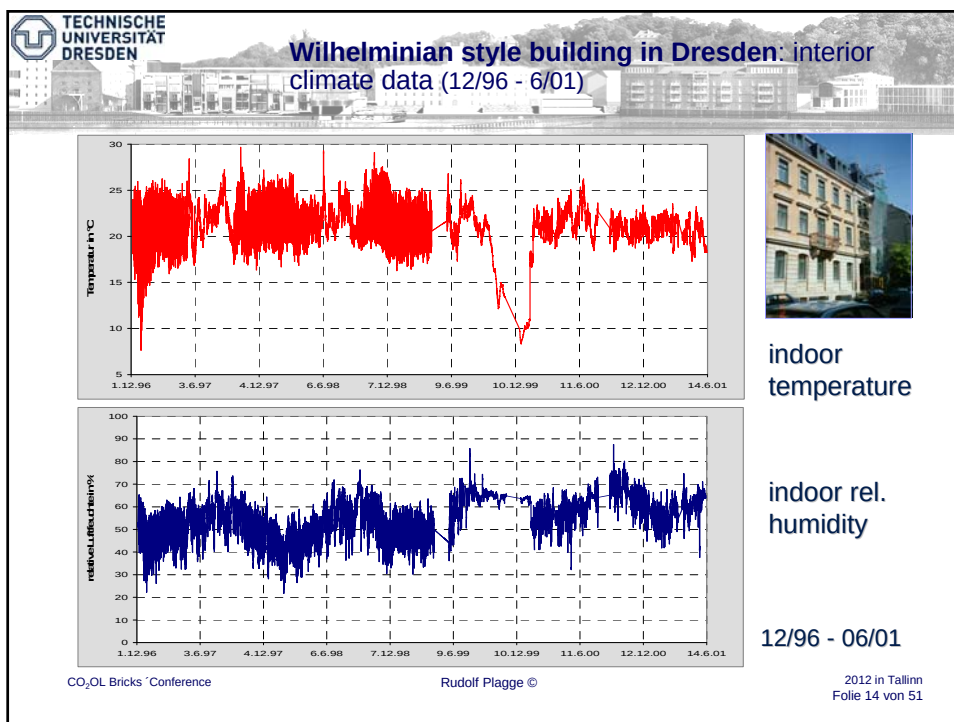
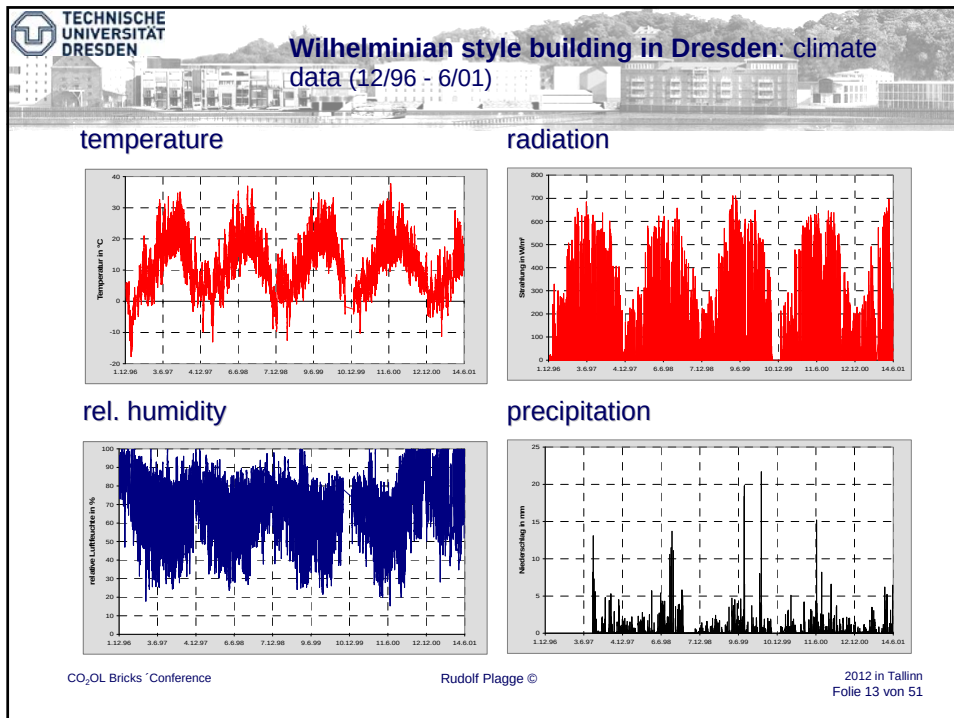


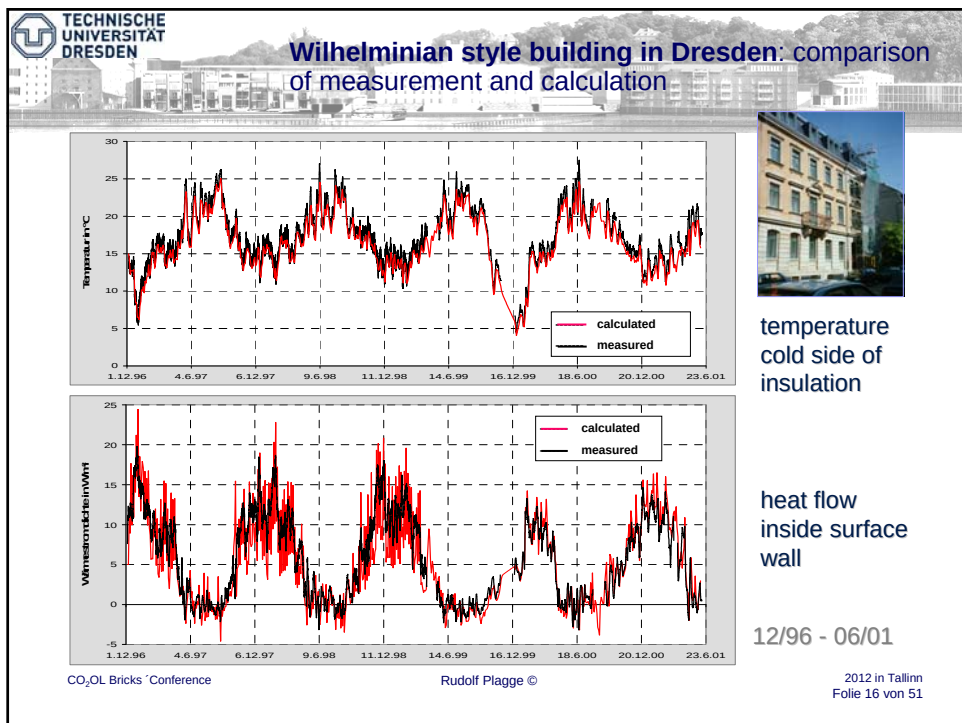
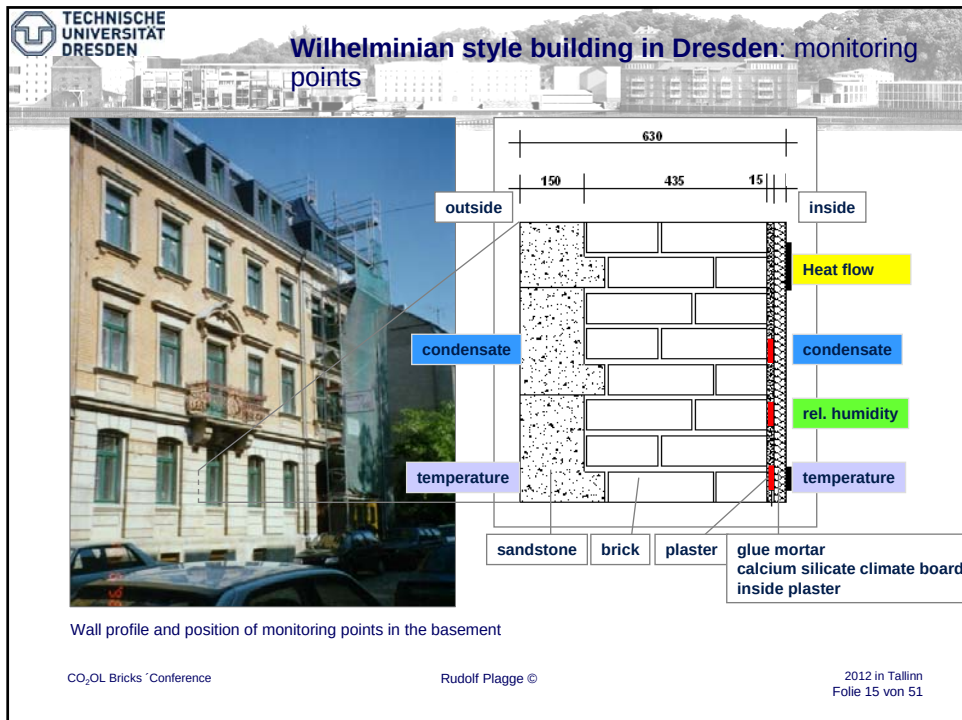
interior insulation



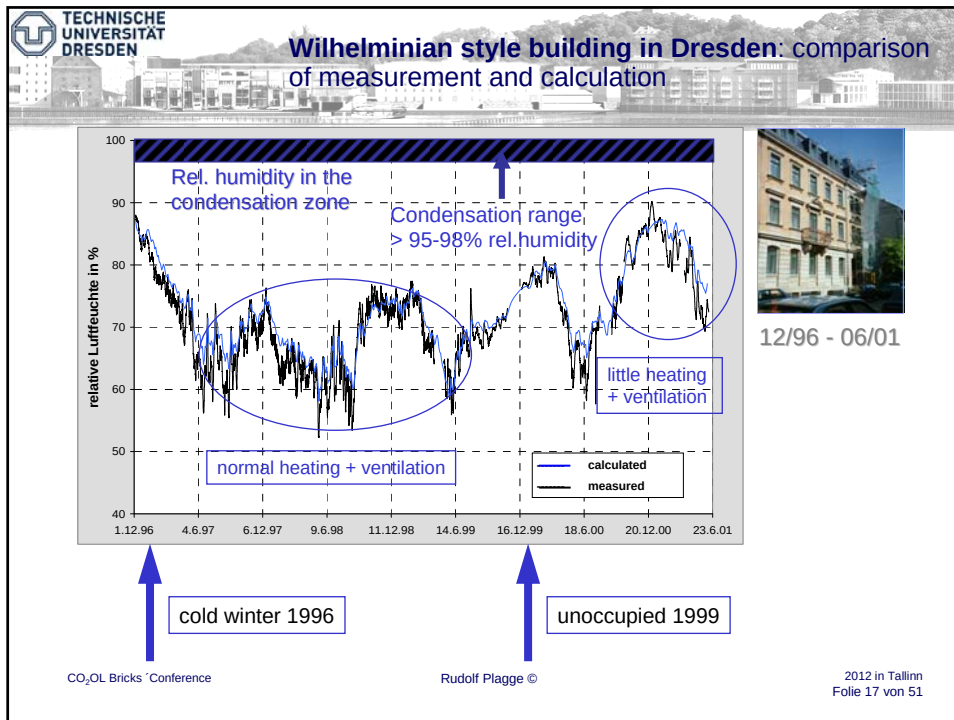
meteorological station

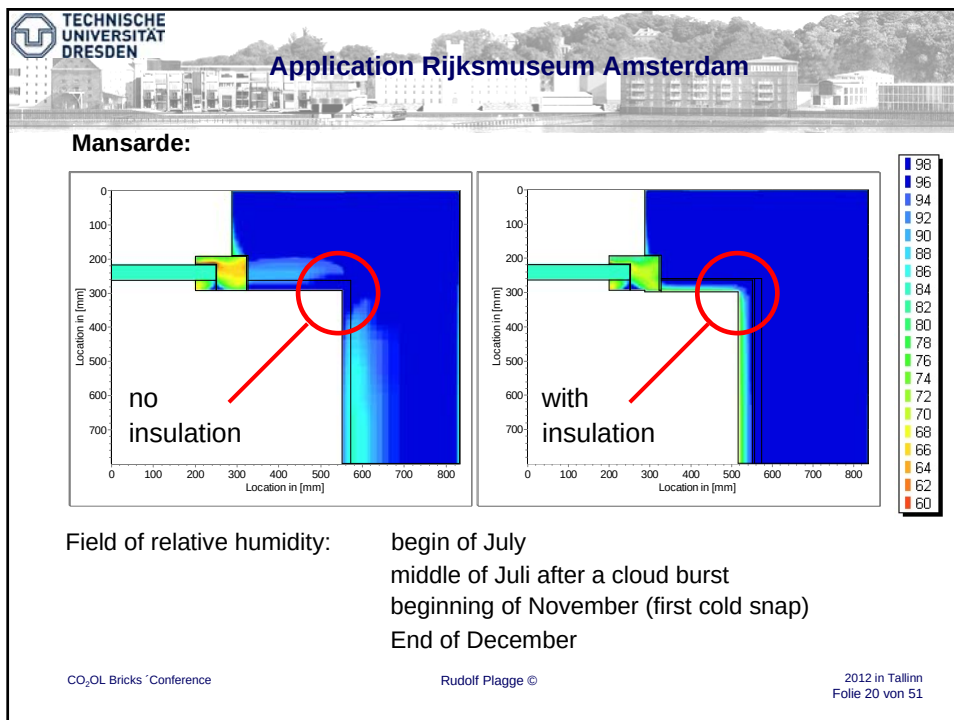
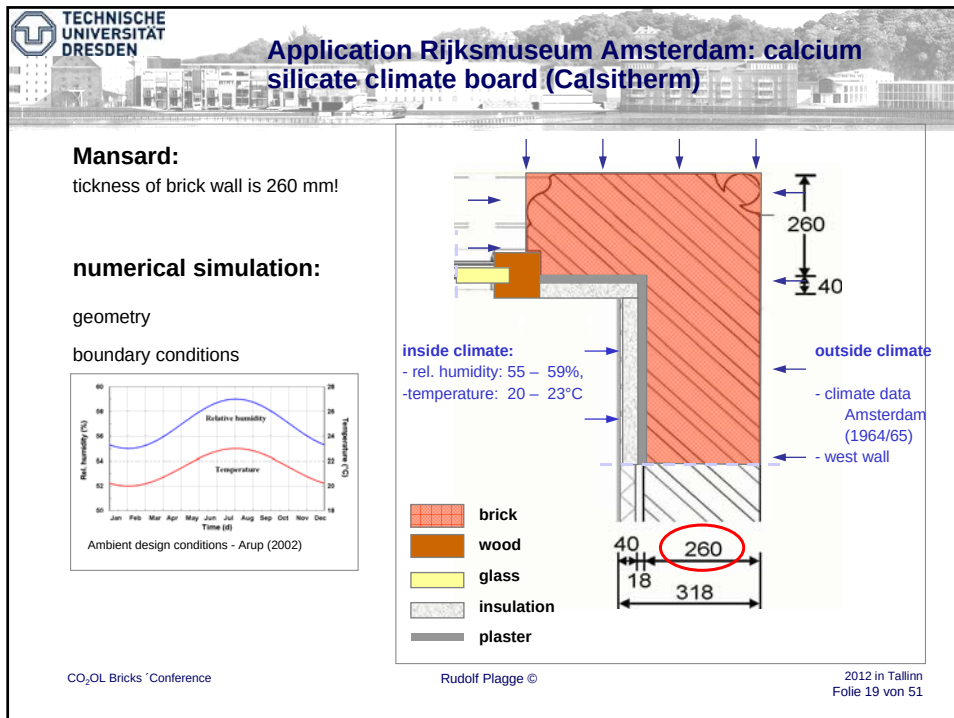


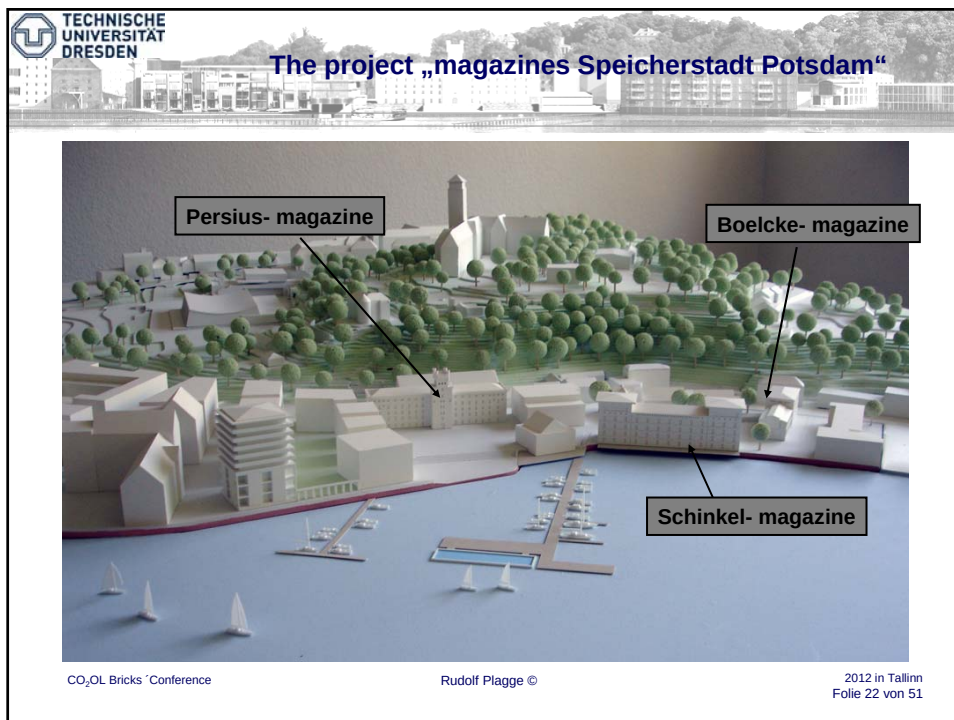
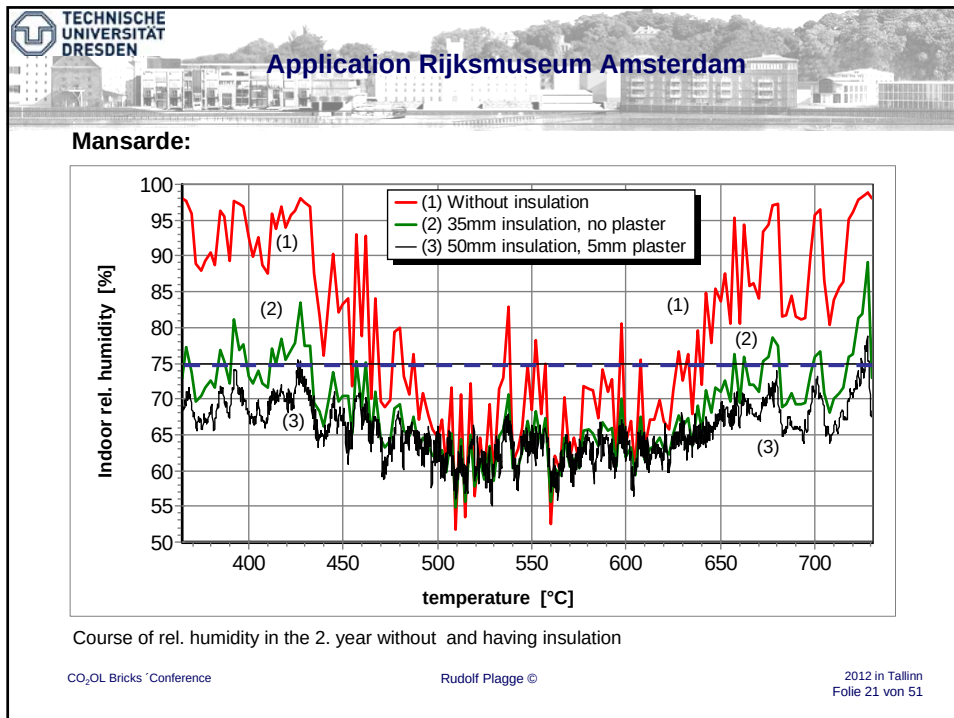














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Schinkelspeicher M3






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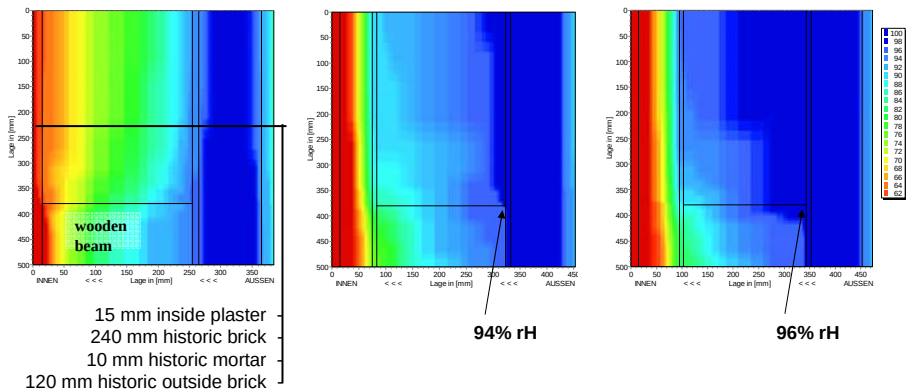
Comparison of insulation loam cork  
without driving rain protection



no insulation

60mm WDL

80mm WDL



15 mm inside plaster  
240 mm historic brick  
10 mm historic mortar  
120 mm historic outside brick

94% rH

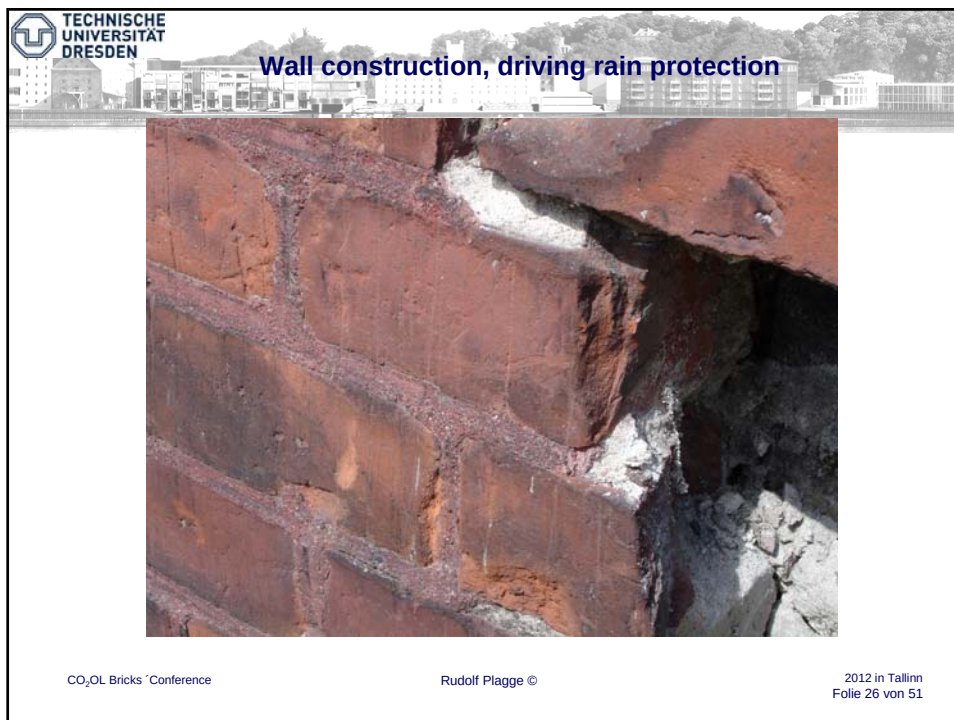
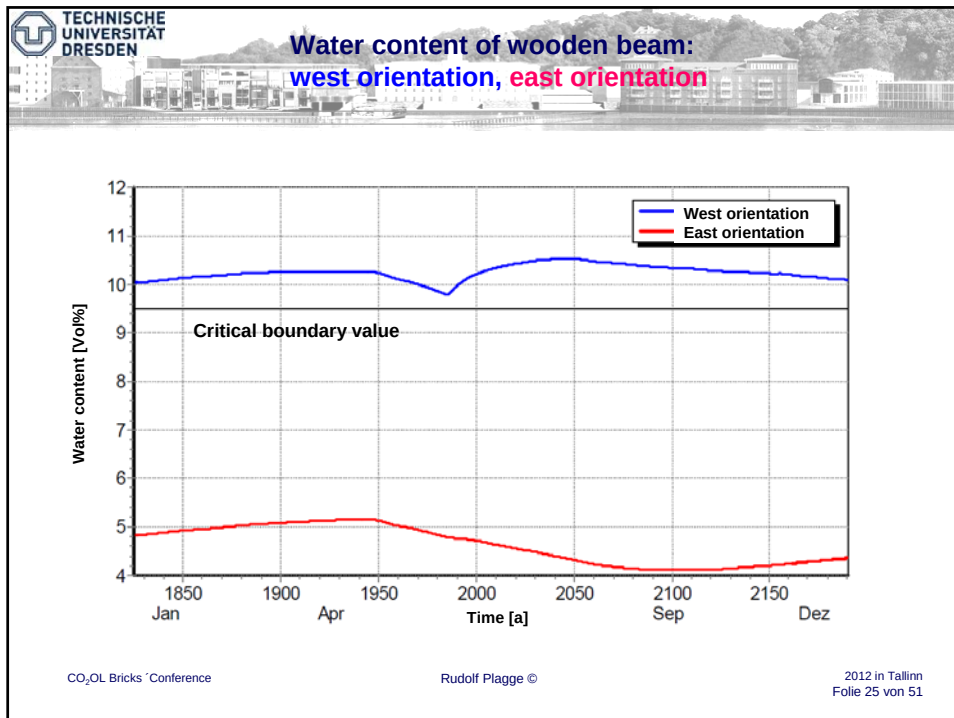
96% rH

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## Problem case mortar joints

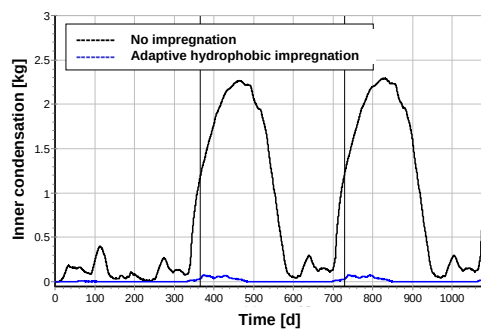


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## Driving rain protection: Adaptive hydrophobic impregnation

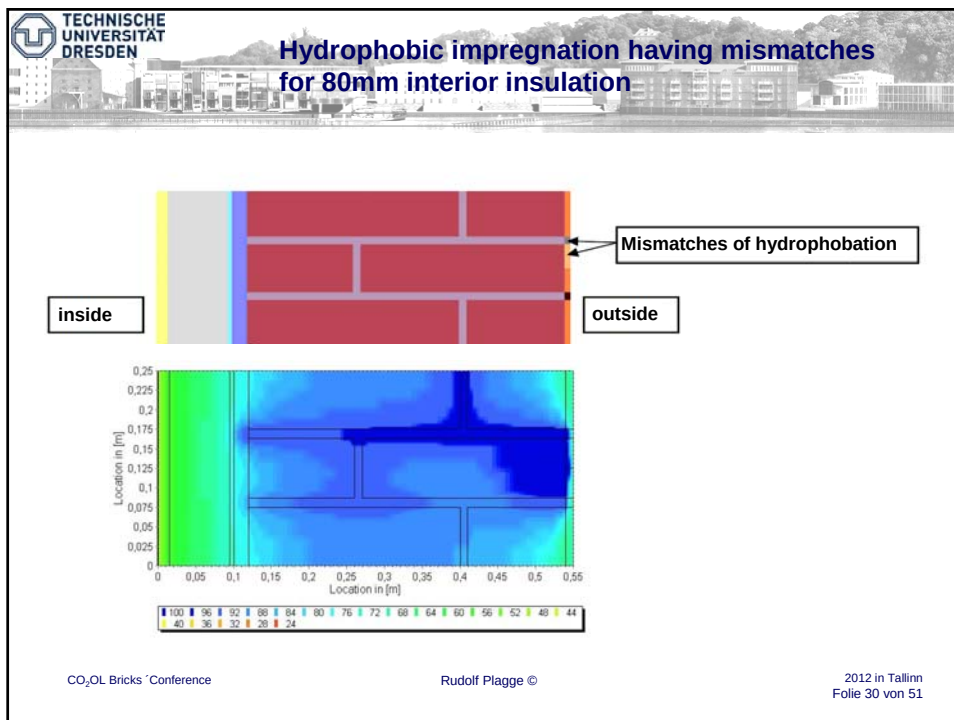
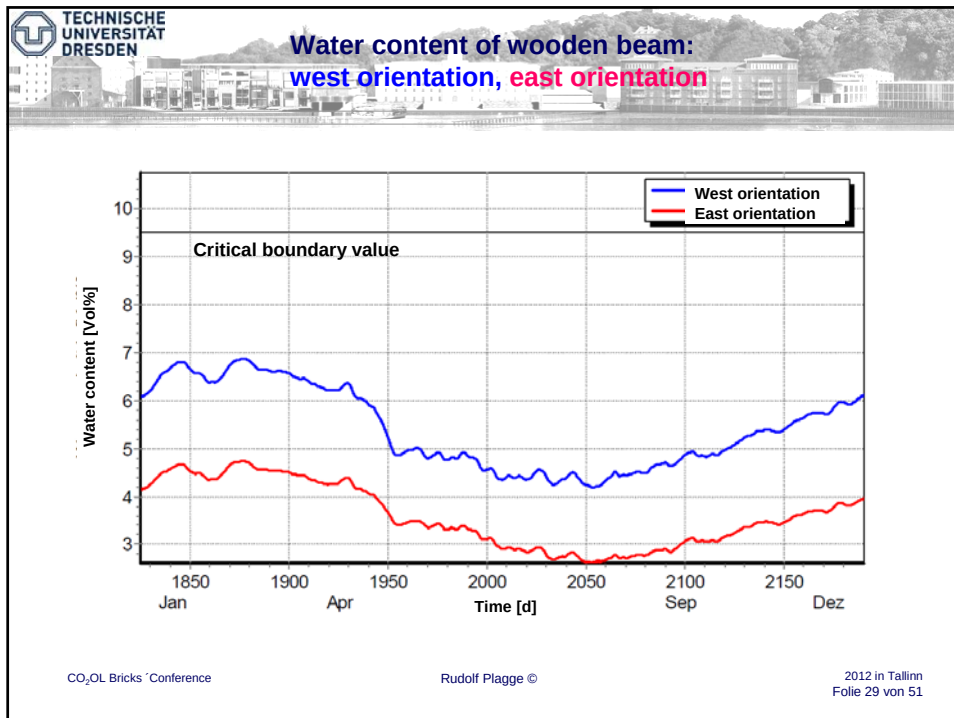


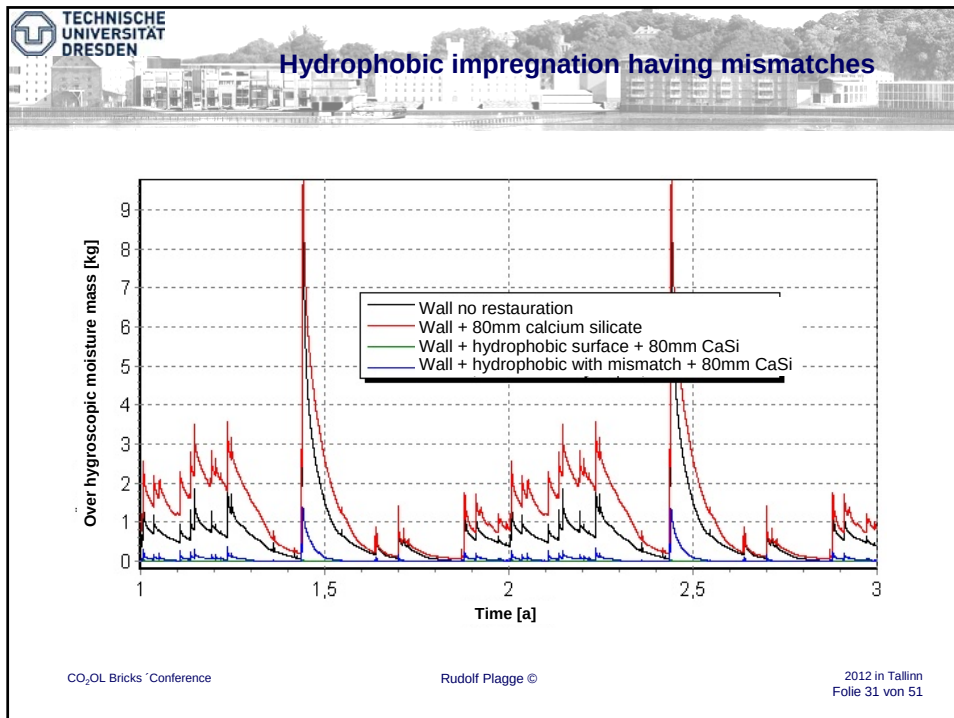
- confident function and durable driving rain protection,
- homogenous infiltration by application > 7mm, here up to 15mm depth,
- applicable on slight moist surfaces → emulsion cream
- keeping drying potential, → no reduction of water vapor transport
- no visual effects after application

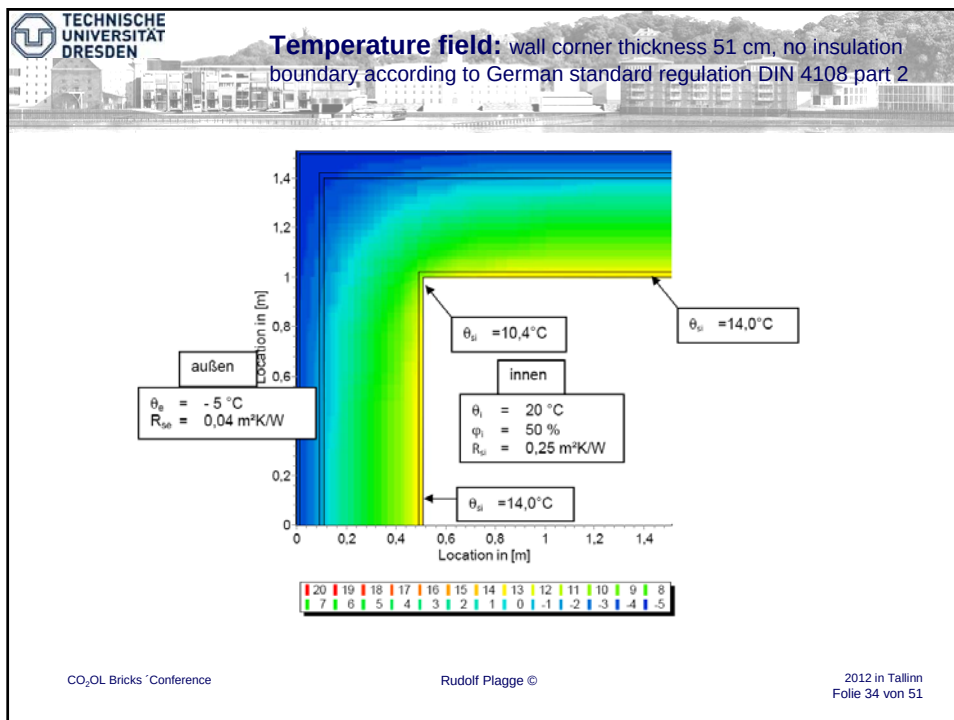
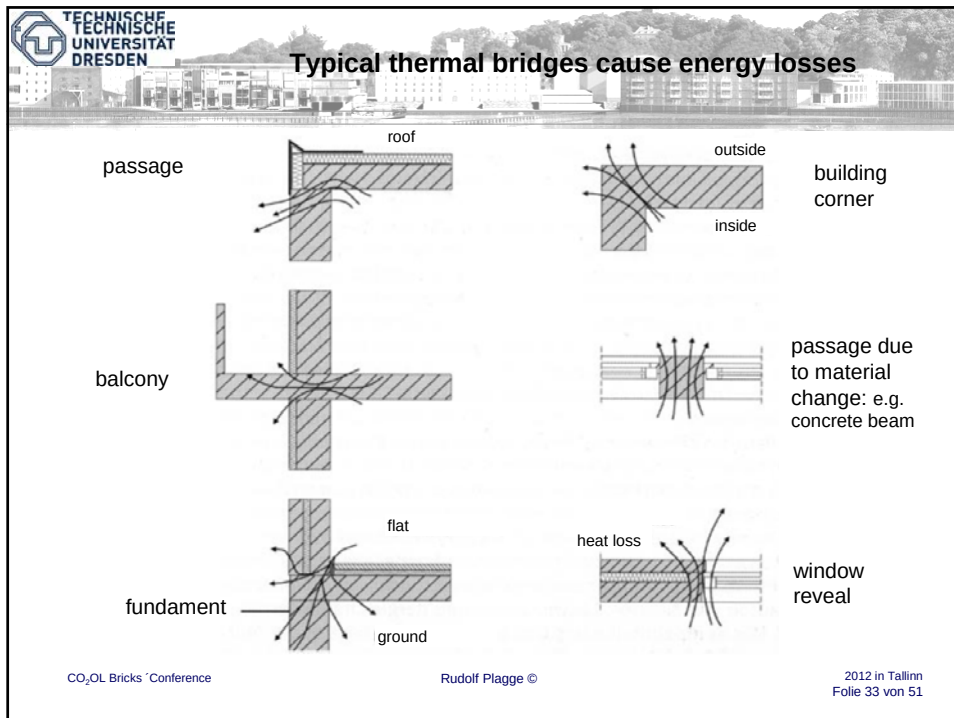
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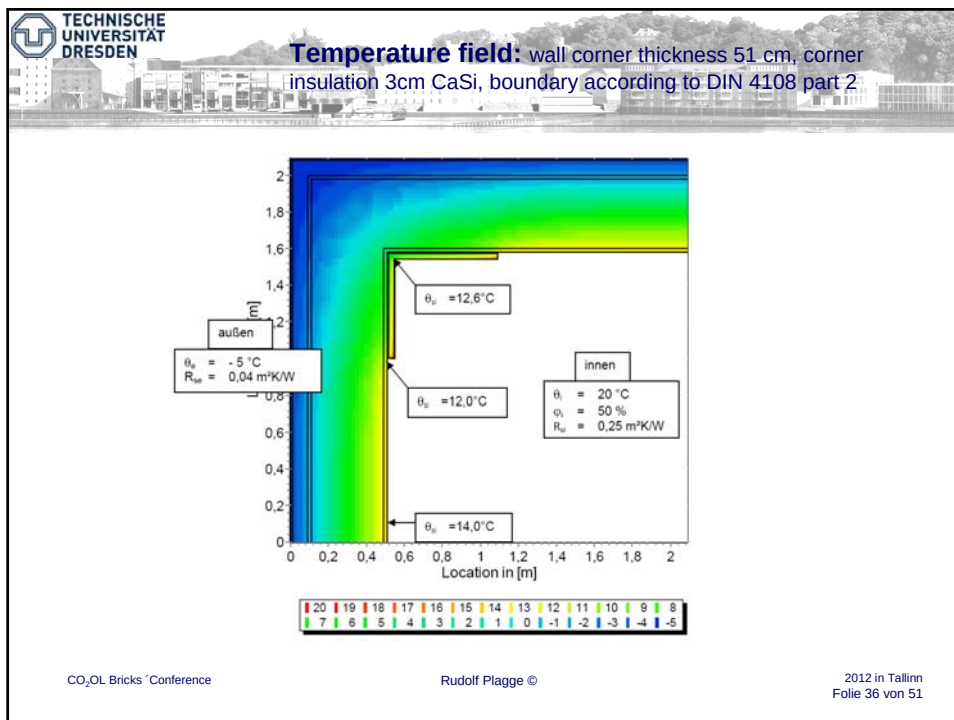
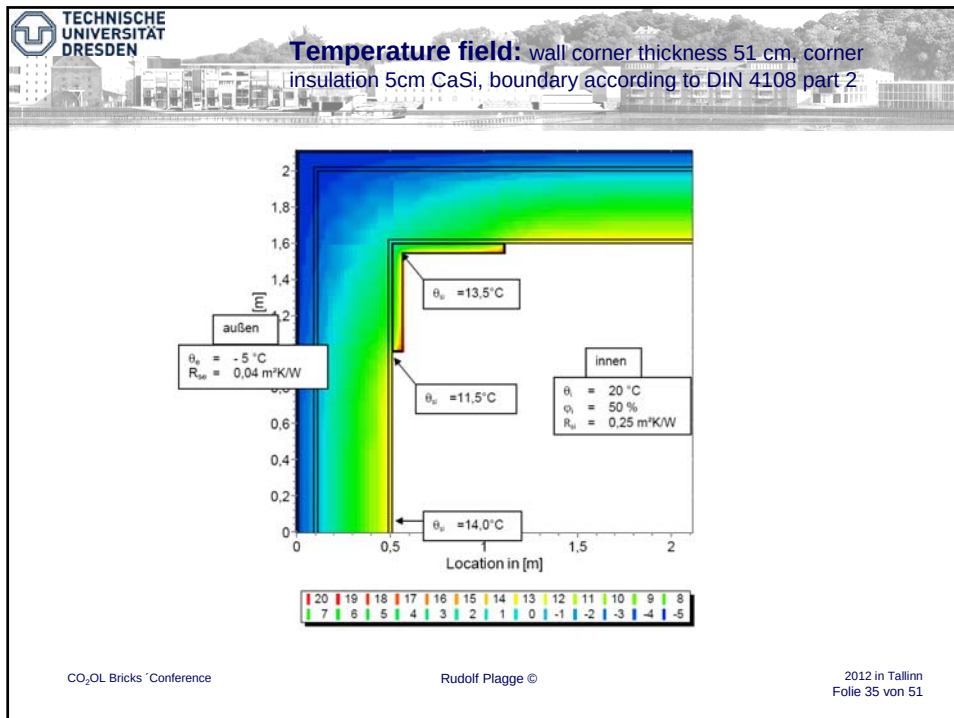
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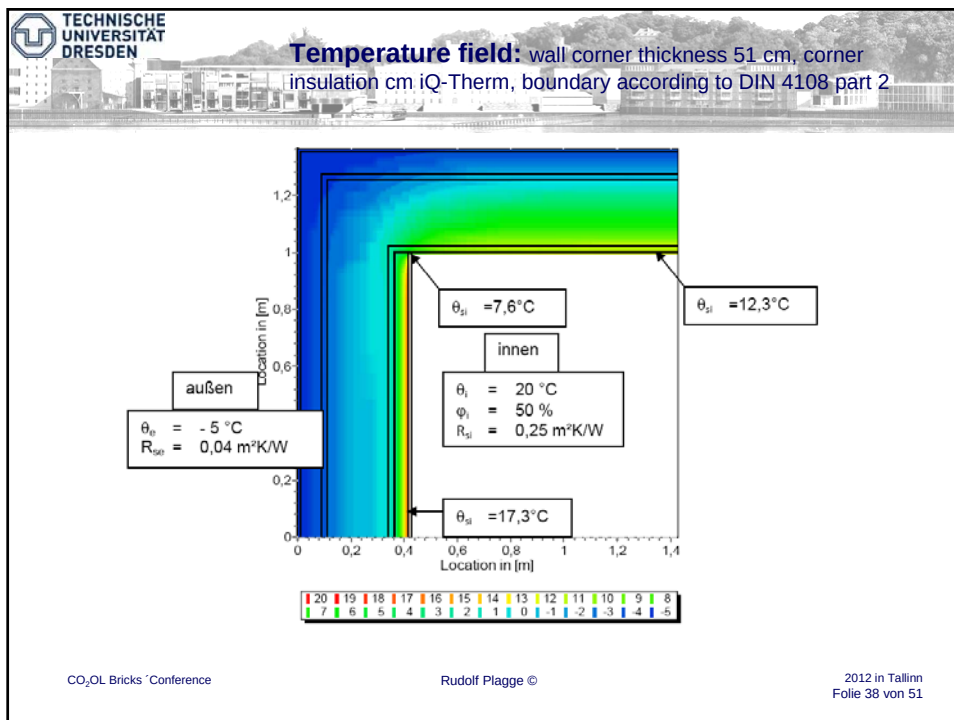
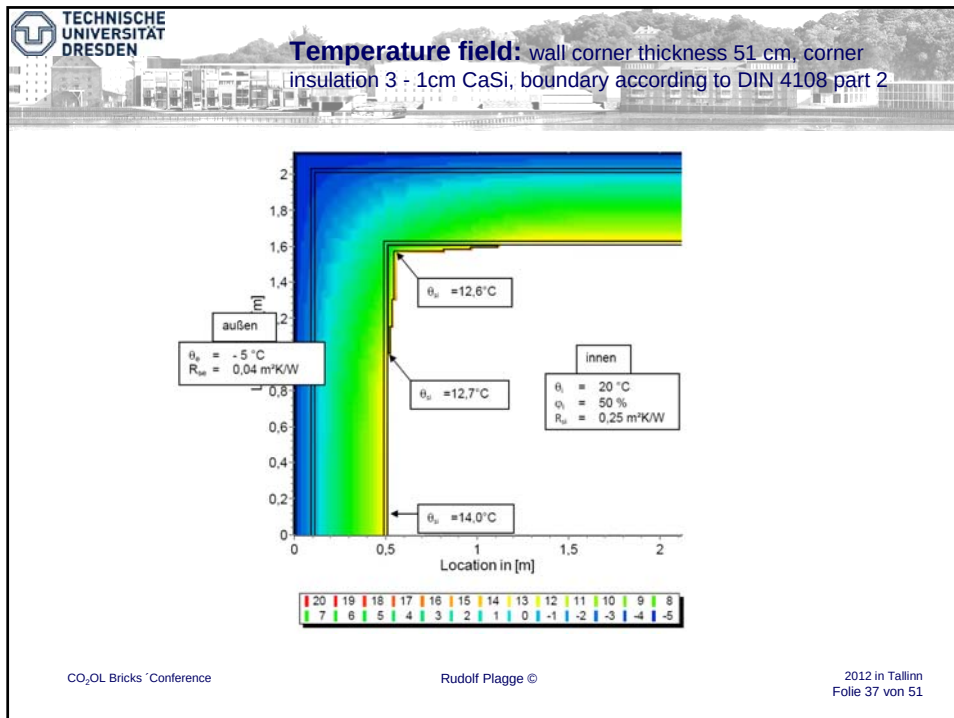


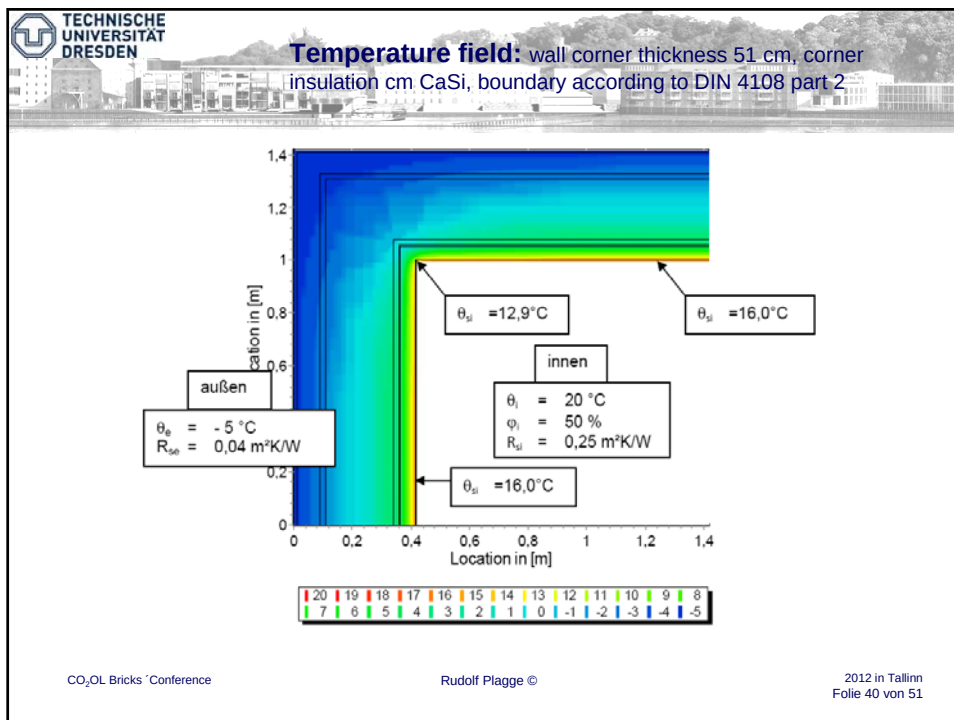
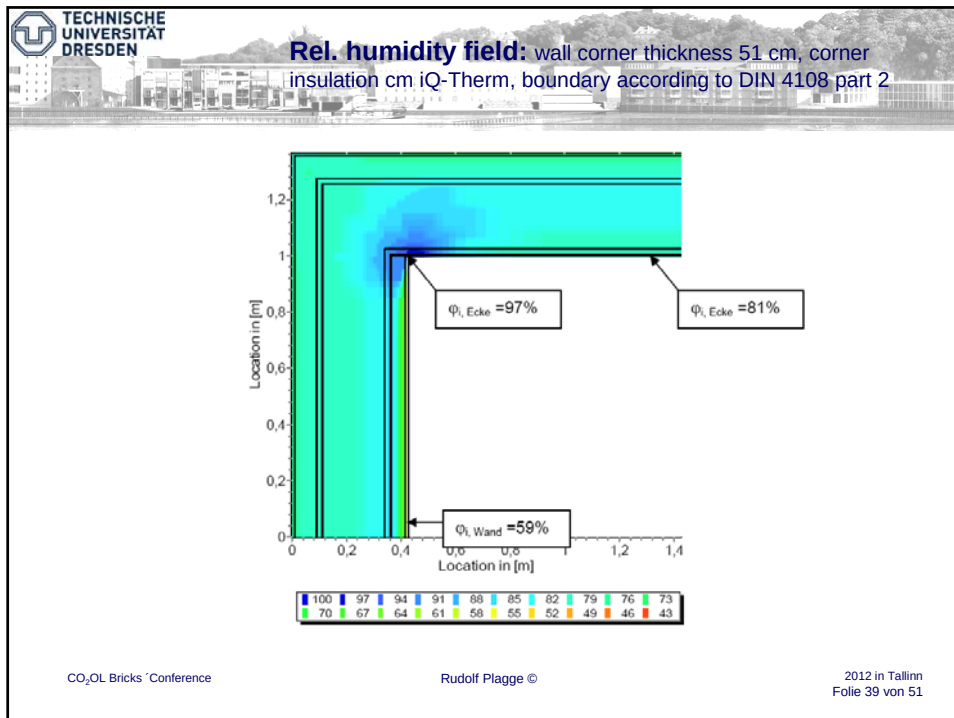


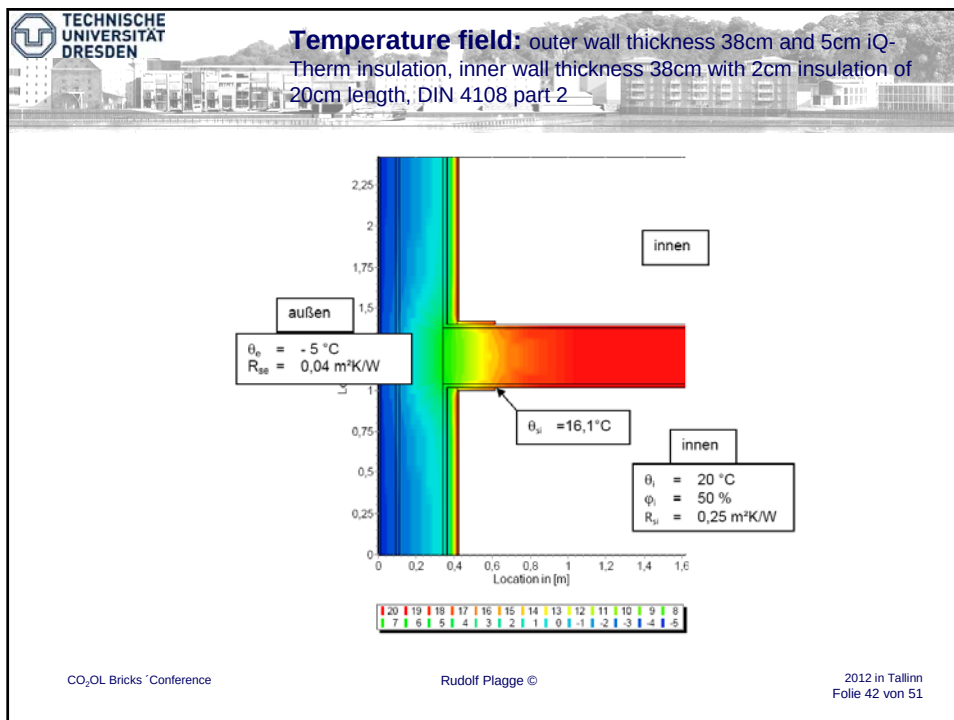
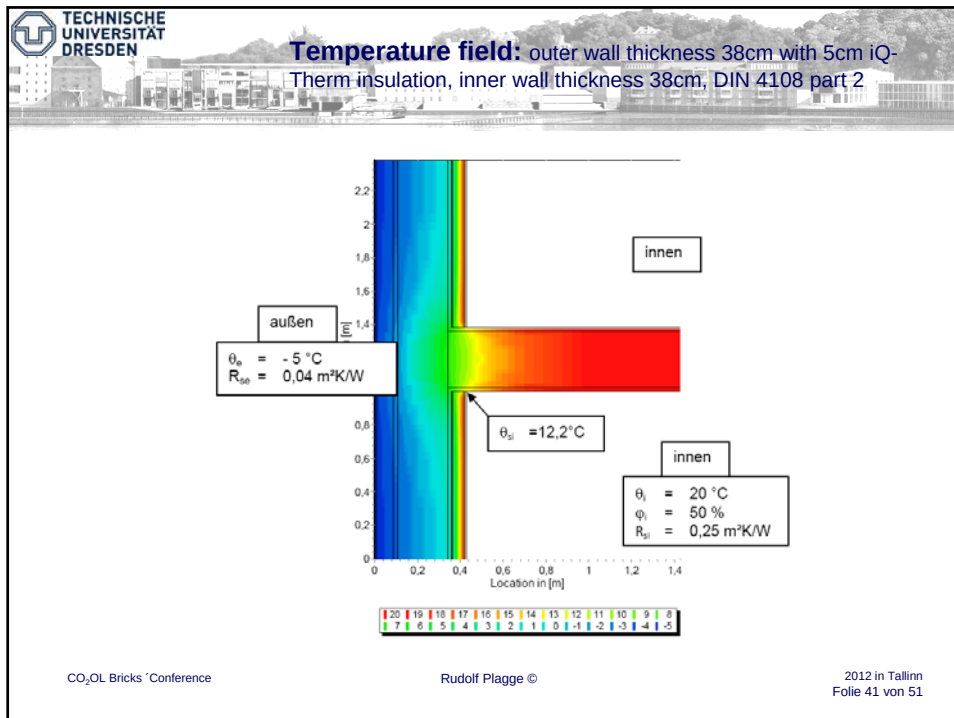




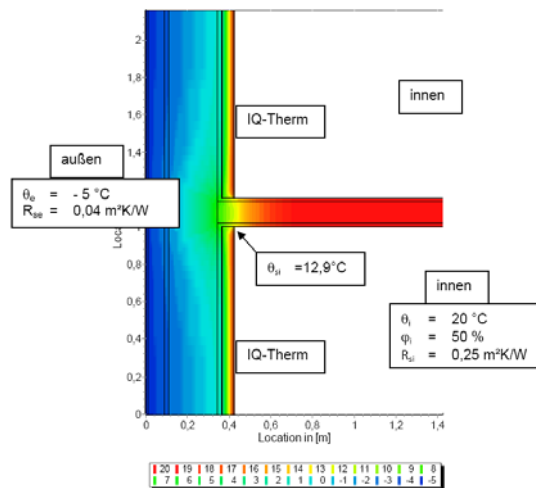








**Temperature field:** outer wall thickness 38cm with 5cm iQ-Therm insulation, inner wall thickness 14cm, DIN 4108 part 2

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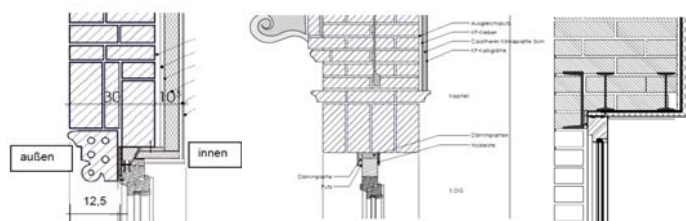
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### Window details:



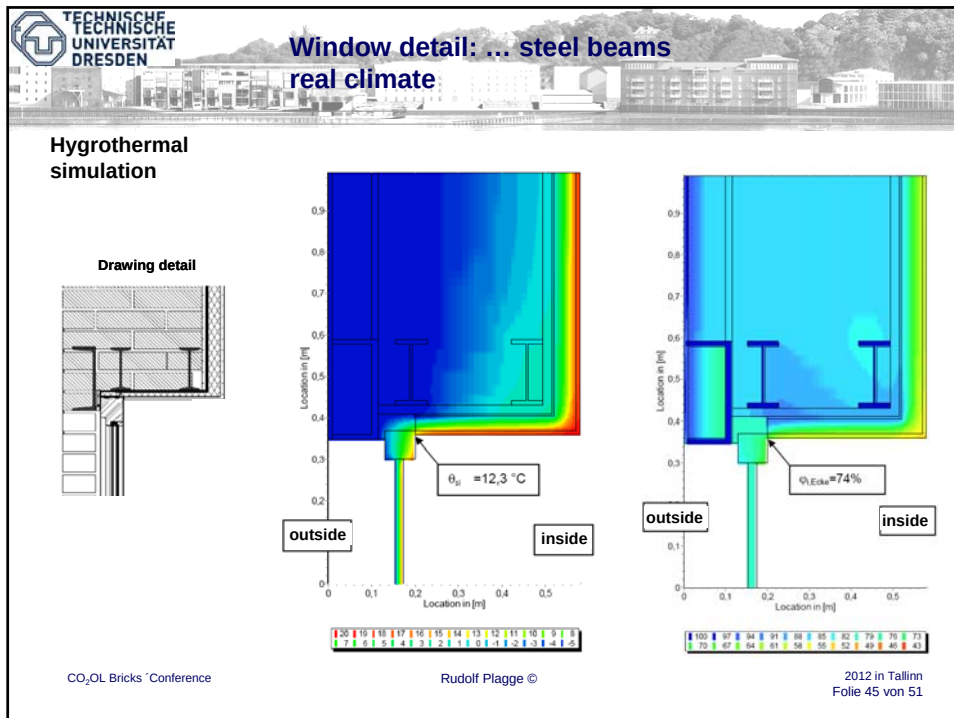
### Westfassade

### Window details

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## Summary

### Positive effects of interior insulation

- Energy saving and CO<sub>2</sub> –reduction, → contribution to the environmental protection
- Protection against condensate and mould growth → prevention of damaged e.g. after window exchange
- Improvement of thermal comfort → increasing value of rehabilitated building
- Keeping brick masonry constructions as they are
- Fast heating for temporary used rooms
- ...

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## Summary



### Advantage of capillary active interior insulation

*(multi functional properties vary between different building materials)*

- Moisture regulation of construction
- Keeping healthy room climate
- Diffusion open construction
- Keeping drying potential
- Reduction of freezing damage probability

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## Summary



- **Evaluation of thermal bridges:** important for damage free building construction
- **Complex construction details:** actual details are very complex, requirement of numerical computer simulation tools
- **Usage of real climate conditions:** the evaluation under national standard code conditions may cause miss interpretation
- **Interior insulation:** thermal calculations only do not deliver proper results
- **Hygrothermal simulation:** the application of hygro thermal simulation is able to evaluate thermal and hygric behavior under real climate conditions and damages can be prevented.

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## Conclusions

### Energetic upgrade of historic building construction requires detailed knowledge in various fields

- building materials
- construction details
- real climate conditions
- hygrothermal simulation tools

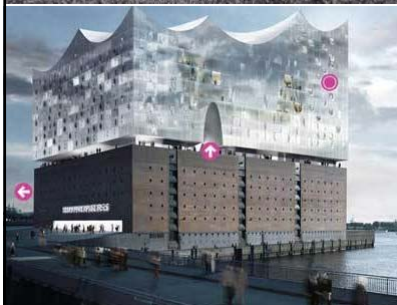
→ A special education is required for an adequate refurbishment

→ New fields of education for architects, engineers, handcraft:

- \_ university level (TU-Dresden)
- \_ graduation level (WTA)

## Cultural heritage interior inside insulation projects

Red Barracks Potsdam



Elbe philharmony Hamburg

### Planning of ~ 60 interior insulation projects during last 20 years and scientific contribution:

- "Am Urban" historic town quarter Berlin
- "Neue Forstakademie" Uni. of Appl. Sci. Eberswalde
- Red city hall Berlin Pankow
- "Herrenschießberg" in Nuremberg
- Karuna Montessorischule Berlin



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